



## CLAIMS

We claim:

- 5 1: A vertical shaft impact rock and ore crusher comprising a main frame, an elevator frame within said main frame, power means to raise and lower said elevator frame, an annular chamber on said elevator frame, and an impeller centered within said chamber, and said impeller connected to a vertical hollow shaft means, and said hollow shaft journalled in an antifriction bearing positioned horizontally within an annular housing, and said 10 annular housing is attached to an annular plate which is attached to a flexible means support which is attached to a steel plate means positioned midway in said main frame, and said annular plate has connections and passage ways for lubricating oils and sealing means, and a cup shaped sheave is attached to top end of said shaft, and power means to rotate said shaft by vee belt driven by said power means suspended below pivotable frames pivoted by power means, and a power driven lube oil pump recirculates oil to said antifriction bearing, , and a static tube centered within said hollow shaft, and said static tube suspended from a top hopper and projecting into said impeller, and bypass means from hopper to chamber, and a hopper below said chamber and having a telescoping means within said 15 hopper, and a swingable boom, and wear resistant tips at exits of impeller.
- 20 2: In a vertical shaft impact rock crusher as in claim 1: a main frame composed with spaced apart horizontal beams supported on four spaced apart parallel columnar beams braced longitudinally and across and extending equally beyond said columns at both ends.
- 25 3: In a vertical shaft impact crusher as in claim 1 or 2: pivotal motor bases positioned near each end of said main frame; said pivotal motor bases pushed pulled by hydraulic means and having electric motors attached to and suspended below said motor bases
- 4: In a vertical shaft impact crusher as in claim 1: a rectangular steel plate positioned at or 30 near the midpoint of its main frame's two horizontal beams on their inward projecting flanges has an opening centered in it and concentric to said opening it supports an annular ring having an elastomer means bonded between it and to a second annular member which

in turn supports an annular plate attached to said flexible member; said annular plate is ported for incoming lube oil fittings, has oil passage ways from fittings to align to vertical oil passage ways in a bearing housing and sealing means, is ported for multiple oil drains; an annular bearing housing is attached to said annular plate, and said bearing housing is 5 drilled for oil passage ways and drilled and threaded for cap screws; an antifriction bearing is positioned within said bearing housing; pressurized lubricating oil is jetted into said bearing from above and below.

5: In a vertical shaft impact crusher as in claim 1: a hollow shaft journalled vertically 10 within an antifriction bearing and extending upward above said bearing a designed distance to position a cup shaped multiple grooved vee sheave to have an equal number of grooves above and below the central plane of said antifriction bearing and be attached to said sheave, and said hollow shaft extends downward a designed distance into a chamber and couples with an impeller,

15 6: In a vertical shaft impact crusher as in claim 1 or 5: a means of coupling a hollow shaft to an impeller in which said shaft has diverging conical segments spaced apart by cylindrical segments of slightly longer arc lengths than said conical segments, and said impeller has converging conical segments with cylindrical segments of slightly longer arc 20 lengths to facilitate engagement of the coupling; said conical segments have matching angles.

7: In a vertical shaft impact crusher as in claim 1 or 5: a hollow shaft and an impeller 25 joined by a segmented conical coupling having means to prevent unintended decoupling by having fixed stops in its hollow shaft and retractable stops in its impeller which are simultaneously pushed inward or pulled outward by camming means.

8: In a vertical shaft impact crusher as in claim 1: an impeller constructed to have a first 30 annular plate means having a concentric opening with intermittent inward converging conical segments spaced between cylindrical segments of slightly larger arcs than said

- conical segments to allow coupling to a hollow shaft and having a second disc plate means spaced evenly apart from said annular plate by intermittent wall means joined to rectangular bar means configured to retain replaceable wear resistant means, and said bar means positioned near the outer perimeters of said annular plate means, and said 5 intermittent wall means have designed arc lengths and curve inward stopping at a designed radius from centerline of said impeller; flat bar means aligned parallel to said centerline and have inner edges joined to ends of said wall means, and said flat bar means having machined recesses and spaced apart bolt holes configured to retain replaceable wear means.
- 10 9: In a vertical shaft impact crusher as in claim 1: an impeller joined to a hollow vertical shaft by segmented conical means is held securely in place by an annular threaded nut having internal matching threads to external threads of a hollow shaft of claim 1 or 5 and an outer diameter having gear teeth, and an attachable gearing means to rotate said nut manually thereby clamping and unclamping coupling means joining an impeller securely to 15 said hollow shaft.
- 10: In a vertical shaft impact crusher as in claim 1: a manual means to rotate a geared nut consisting of a yoke like means attachable to opposed recesses in a shaft, and a gear enclosure attached to said yoke, and a small gear fused to a cap screw is journaled in said 20 enclosure, and means to prevent gears from separating when torque is applied to said cap screw.
- 11: In a vertical shaft impact crusher as in claim 1: wear tips having square cross section with threaded holes in two adjacent sides a slot in the vertex between the other two sides, 25 and carbide or other suitable wear resistant metal inserted in said slot; said tips configured to fit retaining means when turned end to end and being held securely by cap screws when installed in an impeller
- 12: In a vertical shaft impact crusher as in claim 1 or 8: a disk of wear resistant metal 30 covers the top surface of an impeller; said disk has camming means to move multiple

sliding means in to lock and out to unlock said coupling means and to protect said top surface of said impeller from abrasive wear.

5 13: In a vertical shaft impact crusher: an annular telescoping enclosure is attached to the underside of a support plate and extends to minimal running clearance to the top surface of an impeller and surrounds a hollow shaft projecting into a rock chamber.

10 14: In a vertical shaft impact crusher: a rectangular elevator frame is positioned within upright columns of a main frame and has adjustable positioning means using both roller and sliding means that bear against said columns to restrain said elevator frame from horizontal displacement and has means for raising and lowering elevator evenly by parallel hydraulic power means.

15 15: In a vertical shaft impact crusher: as in claim 14: a main frame containing an elevatable frame connected to roller chain means engaging parallel sprocket means on shafts journaled in bearings and joined together by a drive line and universal joints; said elevator held in working position by hooking means; said hooking means disengaged by camming means to permit lowering of said elevator

20 16: In a vertical shaft impact crusher as in claim 14, an annular chamber of designed depth seats on the elevator frame and is centered and attached to said frame; said chamber has a ring shaped bottom plate and contains multiple upstanding vanes, a segmented wear resistant expandable ring seats on said vanes, and a segmented removable cover is attached to the top flange of said annular chamber with angle iron means; said angle iron means form a rectangular opening the perimeter of which is capped by an elastomer having channel shape forming a dust tight seal against a supporting means.

25 17: In a vertical shaft impact crusher as in claim 1 or 14: a conical hopper means below and in contact with the bottom plate of said chamber and attached to said chamber or to

said elevator frame; extending through a bottom opening in said conical hopper a stepped cylindrical member that telescopes upward into said conical hopper.

- 18: In a vertical shaft impact crusher as in claim 1, a hopper means above said main frame resting on column means spaced apart a distance to allow ample clearance to install and remove vee belts driving a multiple grooved vee sheave both across diameter of said sheave and between the top of said sheave and the bottom of said hopper; said column means containing bypass chutes; a static tube flanged at its top end suspends through the hopper bottom and through a hollow shaft into an impeller, and vane like air valves adjusted by exterior means are positioned within recirculating air ducts.
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- 19: In a vertical shaft impact crusher as in claim 1 or 3: two opposed motor bases equidistant from said spindle supported on flanges of said longitudinal beams of said main frame pivot on one beam and rest on rollers on other beam; adjustable stabilizing means hold base means against tipping forces; hydraulic power means joined in parallel push-pull equally said bases to tension or remove tension of multiple vee belts that transfer motor torque to said cup shaped sheave attached to said hollow shaft of claim 1, and means to maintain proper belt tension in push mode.
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- 20: In a vertical shaft impact crusher as in claim 1, a lubricating system consisting of an oil reservoir, an oil line to a pump connected to a small motor having shafts at both ends; universal joints, a slip shaft, and an overrunning clutch join said small motor to a spindle journalled in a bearing housing attached to the top surface of one of the motor bases of claim 18 and having a vee belt sheave on said spindle one or more vee belts from said vee sheave to a similar sheave on the shaft of one main power motors, and said bearing housing configured to be moveable to adjust belt tension; flexible oil lines from pump to connect to said annular member of claim 3 that is ported to receive said oil lines; drain lines from said annular member to said oil reservoir.
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21: In an vertical shaft impact crusher as in claim 1, a swingable boom vertical pivoted in bearing means that accommodate vertical raising and lowering said boom, said boom having a radius from said bearing means to the vertical centerline of an annular cradle at the end of said boom to the centerline of the shaft of claim 1, and jacking means to raise and  
5 lower said boom.